Bel Canto eOne DAC 1.5

DIGITAL TO ANALOGUE CONVERTER

No, despite the Italian name (Bel Canto literally means 'beautiful singing' in Italian), Bel Canto is proudly all-American, and indeed Bel Canto is one of those modern-day rarities: a high-end audio company in which the original founder and lead designer is still the owner and lead designer. That person, in the case of Bel Canto, is none other than John Stronczer. It's also something of a rarity in that Bel Canto still calls the USA home—not just for design, but for all its manufacturing, all of which takes place in Minneapolis, where a small team of just 12 people assembles its products. Stronczer wasn't always in audio. After graduating with a BSc (Electrical Engineering) from the University of Minnesota he started out as a Research Scientist at Honeywell Physical Sciences Centre in Bloomington, Minnesota, where he developed GaAs integrated circuits for communications systems used in defence and aerospace products. Projects he worked on included a next-generation high data rate secure communications chip set for the US government, ultra-low-noise analog sensor electronics for IR sensor applications and development of the world's first complementary GaAs operational amplifier for use in radiation-hardened environments. He has seven US patents for integrated circuit designs.

THE EQUIPMENT

The engineer in Stonczer is reflected in the chassis design of Bel Canto's products, all of which are almost identical externally (by virtue of using exactly the same chassis, front panel controls and front panel) or visually similar (varying only in dimension). While it's a typical engineer's approach, because it minimises inventory and manufacturing costs, it's not popular with marketing departments, because it means there are fewer visual clues for consumers to use to differentiate between different models (and, more importantly for marketing types, to position different models at different price points!).

Although you can perform a few functions with the single rotary control (it also has a pushbutton function) on the front panel, mostly you'll be using the infra-red remote control that comes standard with the DAC1.5. This give you control over a two muting functions ('Soft' and 'Hard'), Volume (Up/Down), and Input Selection. Somewhat confusingly, there are two ways to select the input you want. One is by using the CH/SCAN– and CHAN/SCAN+ buttons (which access the five available inputs sequentially and continuously) and also via the Numeric keypad on the control. If you use the keypad, you press '1' for the AES input, '2' for the SPDIF1 input, '3' for the SPDIF2 input, '4' for the Toslink input and '5' for the USB input. The remote also has a 'Display' button that toggles the display of the DAC1.5 between 'Normal' (where the display is on permanently, and displays level as the default) and 'Display Off' (which turns the display off, though it will always illuminate briefly whenever you adjust a control). You can also use the display button to briefly display the input sample rate (44.1kHz, 48kHz, 96kHz, 192kHz) or, if no digital signal is detected, the letters 'LOS' (Loss Of Signal).

The rear panel of the DAC1.5 has the five digital input connectors you'd expect to find (XLR for the AES/EBU digital input, Toslink for the optical input, 'device' USB for the USB input, and RCA for the two SPDIF inputs. There are two pairs of analogue outputs. One pair is fully balanced, and uses XLR connectors, while the other is unbalanced, and uses RCA outputs. There's also a switch that changes the output level of the DAC1.5 between 'Fixed' and 'Variable'. The 'Variable' is self-explanatory, but the so-called 'Fixed' position is more interesting, because the level isn't 'Fixed' as such (i.e., preset at the factory) but is instead 'Fixed' by the user. The idea is that you set up the DAC1.5 so that the maximum analogue output voltage is ideal for whatever of your analogue components it's connected to, after which you press 'Fixed' and the DAC1.5 will set this as its maximum. Very clever!

The USB input handles up to 24-bit/96kHz data rates. If your computer soundcard delivers higher rates again, Bel Canto recommends using the SPDIF, AES/EBU or Toslink connections of the DAC1.5. Although there's nothing further about this in the User's Guide that comes with the Bel Canto DAC1.5, there is a section on Bel Canto's website that concerns itself with optimising computer audio sources: [http://www.belcantodesign.com/pdfs/BelCantoComputerAudio.pdf]. This an excellent guide, written by Stronczer himself, but you should be warned in advance that he's a fan of the Apple MAC and wears his heart on his sleeve!

One reason Stonczer has been able to keep the Bel Canto DAC1.5 so small is that it uses a very small OEM external power supply. (The DAC1.5 supplied to us came with a supply that didn't have Australian C-Tick approval, but when queried about this, local distributor Wicked Digital said that this was an oversight on the review sample, and that all models supplied to Australian consumers would be provided with a properly approved and suitably labelled power supply.) Initially, I was labouring under the misapprehension that the DAC1.5 shipped with Bel Canto's own power supply, but Steven Lees, of Wicked Digital, told me this was never the case.

He says the three Bel Canto DACs—DAC1.5, DAC2.5 and DAC3.5—have three different power options.

The top-of-the-line Bel Canto DAC35.VB ships without a power supply. It has two options for power, either the VBS1 power supply which can power up to three Bel Canto devices such as the PRe3VB pre-amp, the PHONO3VB Phono pre-amp, and a DAC for example. The second power option is the Bel Canto's LNS1 power supply which will power a single Bel Canto VB device. Lees told me: '*The VBS1 has better performance than the LNS1 so the VBS1 is the best choice for the DAC3.5VB.*' The DAC2.5 ships with the LNS1 power supply built into the chassis, and does not have the option to upgrade to the VBS1. Lees told me that while the DAC1.5 does not have a standard VBS power connector, Bel Canto has a cable option that allows it to be connected to either an LNS1 or a VBS1 power supply. He pointed out that it didn't make economic sense to use a Bel Canto outboard supply if you were buying a brand-new DAC1.5. In a reply to an emailed question he wrote: '*From a cost point of view you would be better advised to buy a DAC2.5 with its added feature of an analogue input.*'

And if you're wondering what the VBS1 is, the letters stand for 'Virtual Battery Supply'. This is because an ordinary battery is generally regarded as offering the dual advantages of low noise and high current while also offering total isolation from the usually-noisy 240VAC mains power. Some companies do indeed power their products via a battery, but this is generally an impractical solution.

INSIDE THE BOX

The Bel Canto DAC1.5 uses a PCM1796 dual-differential multi-bit delta-sigma DAC running at 192kHz with a high-performance linear-phase, slow roll-off digital filter. This optimises both the time domain and the frequency domain performance of the filter and only requires a simple analogue filter in the analogue output stage to eliminate out-of-band signals. Volume control is handled totally in the digital domain, with a 24-bit fully dithered digital level control, so there's no quantisation noise introduced at any setting of the volume control.

The 'Master Reference Ultra-Clock' inside the DAC1.5 is specified as having timing accuracy of better than 2 picoseconds RMS and frequency accuracy of 0.0001%, which Bel Canto claims enables it to provide jitter performance '*50× better than other clocks*'. The Ultra-Clock circuit is preceded by a new 2Hz digital PLL stage that rolls off incoming jitter by more than 10× at 10Hz and by more than 10,000× above 100Hz.

IN USE AND LISTENING SESSIONS

Having been caught out once or twice with previous DACs, one of the first things I checked was whether the two analogue outputs fitted to the Bel Canto DAC1.5 could be used simultaneously. Yep! They can. No cost-cutting here. This means, for example, that you could (if you wished) connect the Bel Canto DAC1.5's balanced XLR outputs to your main system and its RCA outputs to a powered subwoofer (or run the higher-voltage balanced line to a separate amplifier and speakers in another room).

After that, it was plain sailing because, without exception, I achieved better sound from DAC1.5 when it was connected to any device with a digital output than I achieved from that device's own analogue output. So it's one of those rare cases where inserting an additional device in the audio chain actually delivered improved sound! Now quite frankly I would have expected this result with many of the source components I used, which were CD and DVD players that were either rather long in the tooth or brand-new but fairly modestly-priced, at around $1,500 to $2,500. However, I was a bit stunned when I connected the DAC1.5 to the co-axial digital output of a very highly-regarded, recently-released audiophile CD player and discovered that the sound issuing from the XLR analogue outputs of the DAC1.5 was easily equal to the sound issuing from the analogue outputs of the CD player. I was stunned because the CD player in question normally retails for around ten times the price Wicked is asking for the DAC1.5. I'm not game to name the model and brand, because the CD player is owned by a friend of mine who regularly reads my reviews, and I don't want to upset him! (Luckily, it wasn't one of my reviews that inspired him to buy it.) When I say 'easily equal' I was A–B switching between the two and I couldn't hear any differences between the noise floors (both were magically silent), or the frequency responses (both were beautifully balanced and obviously extended to the max at both high and low ends of the audio spectrum) and as for distortion… well that was a total non-event. I couldn't hear any when playing CDs whose recorded levels I know approached 0dB, and I also couldn't hear any 'grunge' at low recorded levels that would have betrayed the presence of quantisation noise. I realise this sounds a little technical, so for those who'd like my report on a comparison using music as a source, I can only say that when listening to music, and switching back and forth between the output of the CD player and the output of the Bel Canto DAC1.5, I couldn't hear any difference between them—not one scintilla!

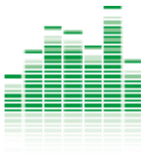
CONCLUSION

My experience with the performance of the Bel Canto DAC1.5 is such that it's caused me to re-think my approach to putting together a high-end audio system. If the sound of the DAC1.5 is the equal of the sound of a highly-regarded high-end CD player ten times its price (which I have proved to my own satisfaction), there would seem to be a very good argument for buying a low-cost CD or DVD player with a digital output, and connecting it to a DAC1.5. This means you'd get superb sound and, when the transport or laser inside that CD or DVD player fails (as one or the other inevitably will) you don't even bother repairing it: you just throw it away and buy a new one! This separate DAC approach to audio is also a really cost-effective approach if you (like me) are on the cusp of transitioning to storing your music in a hi-res format on hard disk, because of course the DAC1.5 is set up to link to your computer, either via USB, AES/EBU or optically (though I wouldn't personally recommend the latter). Mmmmm… don't bother me, I'm thinking…

George Newlund

BEL CANTO
eOne DAC1.5

BRAND: Bel Canto
MODEL: eOne DAC1.5
CATEGORY: DAC
RRP: $1,895
WARRANTY: Two Years
DISTRIBUTOR: Wicked Digital
ADDRESS: Suite 118. 40 Yeo Street
Neutral Bay, NSW 2089
☎ **1300 652 802**
✉ **info@wickeddigital.com.au**
💻 **www.wickeddigital.com.au**



- Superb performance
- Multi-format
- Ability to set level

- No analogue input

LAB REPORT

Readers interested in a full technical appraisal of the performance of the Bel Canto eOne DAC1.5 should continue on and read the LABORATORY REPORT published on page 93. Readers should note that the results mentioned in the report, tabulated in performance charts and/or displayed using graphs and/or photographs should be construed as applying only to the specific sample tested.

Lab Report on page 93

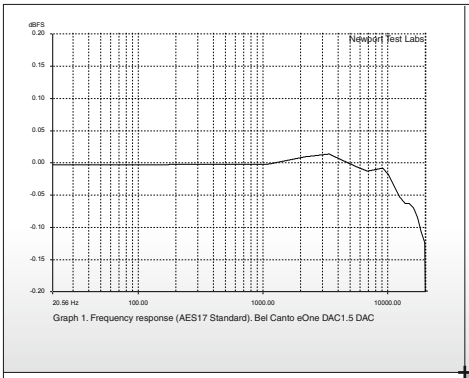
SEE REVIEW ON PAGE 38

TEST RESULTS

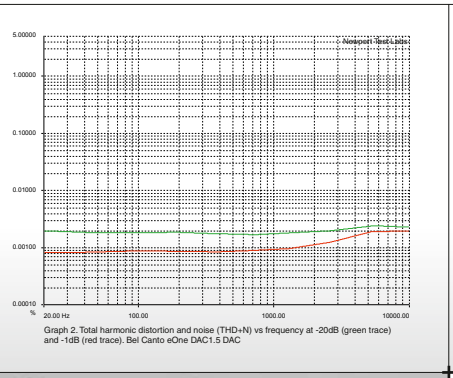
The measured performance of Bel Canto's DAC1.5 was excellent across the board. It returned excellent results across all the tests performed by *Newport Test Labs*, all of which are reported in the test result table on this page and depicted in the accompanying graphs. You can see that output voltage was just slightly above the maximum specified by Bel Canto (2.0V), measuring 2.0677 volts in the left channel and fractionally less in the right, for a channel balance of 0.0362dB. I should note that the results in the table were sourced when the DAC1.5 was being driven by the digital output of a CD transport playing a test CD, whereas all the graphs (with the exception of the frequency response graph) were conducted entirely in the digital domain using digital signal generator. You can see that the frequency response in *Graph 1* rolls off slightly at high frequencies, but ends up only 0.143dB down at 20kHz, for an overall result of 20Hz to 20kHz ±0.07dB. Channel separation was exceptionally good, with a best result of 130dB at 1kHz. THD was also very low overall (0.00129%) but you can also see the results cross-referenced against discrete frequencies in *Graph 2*. Channel phase was low. Group delay was about what I usually see from digital-to-analogue converters that use the PCM1796 IC. Signal-to-noise was excellent, as you can see, at 110dB IHF-A weighted, but improved during AES17 testing to an even-better 119dB (CCIR-weighted). You can see that not only has Bel Canto implemented the de-emphasis circuit in the DAC1.5 but that it's done so almost perfectly, with only a tiny error of 0.17dB at 16kHz. Linearity error was also vanishingly low: this is graphed in *Graph 3*. CCIF-IMD was measured at –103dB. Absolute phase (not shown) was non-inverting. Mains power consumption was low: 5.02-watts. ***Steve Holding***

Bel Canto eOne DAC1.5 Test Results

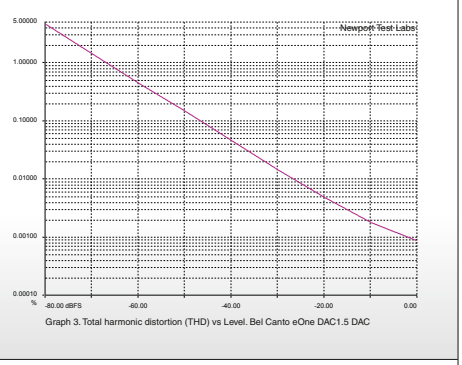
Analogue Section	Result	Units/Comment
Output Voltage	2.0677 / 2.0591	volts (Left Ch/ Right Ch)
Frequency Response	+0.01 / –0.143	dB (20Hz – 20kHz)
Channel Separation	127 / 130 / 113	dB at 16Hz / 1kHz / 20kHz
THD+N	0.00129%	@ 1kHz @ 0dBFS
Channel Balance	0.0362dB	@ 1kHz @ 0dBFS
Channel Phase	0.03 / 0.01 / 0.15	degrees at 16Hz / 1kHz / 20kHz
Group Delay	–3.86 / 5.38	degrees (1–20kHz / 20–1kHz)
Signal-to-Noise Ratio (No Pre-emph)	104 / 110	dB (unweighted/weighted)
De-Emphasis Error	0.00 / 0.00 / 0.17	at 1kHz / 4kHz / 16kHz
Linearity Error @ –60.00dB / –70.00dB	0.03 / 0.01	dB (Test Signal Not Dithered)
Linearity Error @ –80.59dB / –85.24dB	0.08 / 0.10	dB (Test Signal Not Dithered)
Linearity Error @ –89.46dB / –91.24dB	0.10 / 0.08	dB (Test Signal Not Dithered)
Linearity Error @ –80.70dB / –90.31dB	0.03 / 0.10	dB (Test Signal Dithered)
Power Consumption	NA / 5.02	watts (Standby / On)
Mains Voltage During Testing	241 – 253 volts	(Minimum – Maximum)



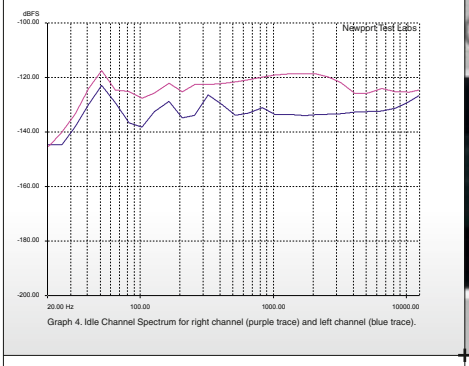
Graph 1. Frequency response (AES17 Standard). Bel Canto eOne DAC1.5 DAC



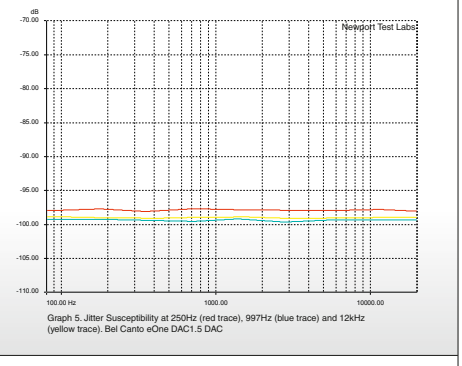
Graph 2. Total harmonic distortion and noise (THD+N) vs frequency at -20dB (green trace) and -1dB (red trace). Bel Canto eOne DAC1.5 DAC



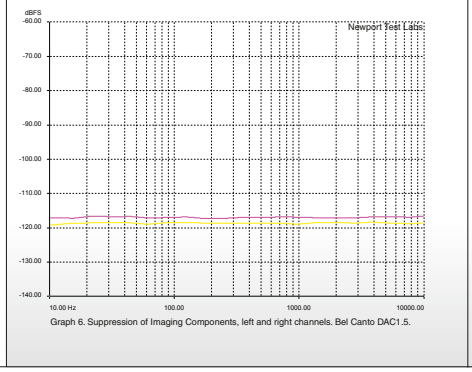
Graph 3. Total harmonic distortion (THD) vs Level. Bel Canto eOne DAC1.5 DAC



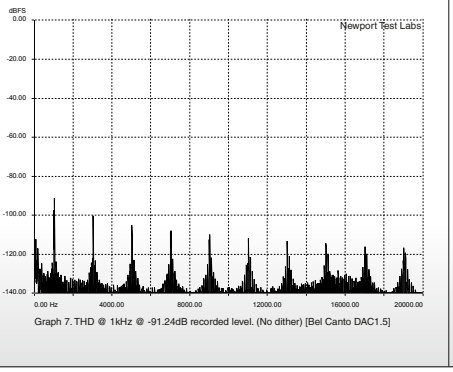
Graph 4. Idle Channel Spectrum for right channel (purple trace) and left channel (blue trace).



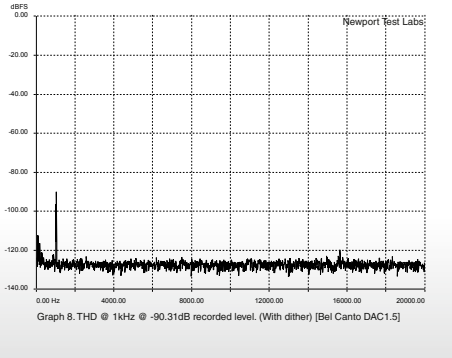
Graph 5. Jitter Susceptibility at 250Hz (red trace), 997Hz (blue trace) and 12kHz (yellow trace). Bel Canto eOne DAC1.5 DAC



Graph 6. Suppression of Imaging Components, left and right channels. Bel Canto DAC1.5.



Graph 7. THD @ 1kHz @ -91.24dB recorded level. (No dither) [Bel Canto DAC1.5]



Graph 8. THD @ 1kHz @ -90.31dB recorded level. (With dither) [Bel Canto DAC1.5]